A Short Primer on Assistive Technology for the Deaf and Hard of Hearing

Types of AT for the Deaf and Hard of Hearing

There are three general types of devices especially designed or modified for the deaf and hard of hearing. All are considered Assistive Technology products or services:

1) **Telecommunications Equipment:** This includes telephones, relay services, and TTY's, also called TDD's or TT's. This category may also include computers, video relay services and equipment, closed-captioned televisions and some wireless devices. Many telephones designed for the hard of hearing incorporate the same "coupling" techniques used in Assistive Listening Devices described below. Text and video communications devices are not discussed here.

2) **Alerting Devices:** This category includes things like alarm clocks, pagers, doorbells, smoke/fire alarms, timers, sound sensors, etc. that signal some event a person needs to know about. Alerting devices may signal an alert with any combination of light, vibration, or very loud sounds.

3) **Assistive Listening Devices (ALD's):** This general category includes devices such as handheld amplifiers that provide amplification to enable the hard of hearing to better perceive or discriminate sound, and also devices like FM systems, that bring a sound signal from its source directly to the ear or hearing aid. They reduce or eliminate the negative effects of distance, background noise and room acoustics. ALD's are used primarily by persons who have some level of hearing, aided or not, or who have cochlear implants.

The Three C's of AT for the Deaf and Hard of Hearing

AT Devices for the Deaf and Hard of Hearing all do their jobs in essentially the same way. They:

1) **CATCH** the sound or signal, by means of a microphone or sensor.
2) **CARRY** the signal, that is, move the signal across a space, bypassing the effects of distance and/or interfering noises.
3) **COUPLE** the signal to the user's ears (for ALD's and certain telecommunications devices) or other sensory apparatus (vision, touch, etc.) for alerting or communicating.

CATCHing the desired signal from the environment

Microphones are used for direct sound pickup, especially with ALD's. When available, a direct electrical connection to an audio source, such as a home entertainment system (TV, radio, CD, DVD, etc.), will provide better sound quality. Sensors for alerting devices include microphones (e.g. to "hear" glass breaking or a baby crying), switches (e.g. a doorbell button), smoke detectors, telephone ring detectors, vibration sensors (e.g. to "hear" a knock on the door), etc. In short, there is a sensor for almost any event or occurrence that someone would like to be alerted to.

CARRYing the signal to the user

Let's focus on ALD's for a moment. Where the speaker/sound source is separated from the listener by some distance, there are 2 main categories of devices used to carry the signal. These describe how the signal is carried from the source to the listener:

1) **Hardwired devices:** A wire or cable carries the signal from the sound source to the listener. A personal amplifier equipped with a long extension cord and microphone at the speaker's position would be one example, as would a headset with a long extension cord to an amplifier or PA system.
2) **Wireless devices:** The device used by the listener is not physically connected to the source or any device at the sound source. Rather, the signal is carried (transmitted) from the source to a receiver at or near the listener. The most common technologies are:
   a) **FM** – the sound signal is sent by radio waves from a transmitter at the source to a receiver (like an FM radio) at the listener.
   b) **Infrared (IR)** – the sound signal is converted and transmitted by invisible infrared light.
   c) **Induction** – the sound signal is transmitted by electromagnetic waves. The receiver is an "induction loop" antenna, and may be a "t-coil" integrated into the user's hearing aid.

Alerting devices can also be hardwired or wireless. Typically, IR and Induction are <u>not</u> used for carrying alerting signals. Hardwired, wireless FM, or other radio frequency signaling is common, as are "pseudo-wireless" systems that communicate via the electrical wiring of a building or home. Also, computer networks are being used more and more for both communicating and alerting.

COUPLing the signal to the listener: Getting the message home

ALD's usually send their signal to the listener's ear(s) with headphones, neckloops, silhouettes, or the listener's own hearing aid(s). Additional amplification may be provided. People without hearing aids, or whose hearing aids are not equipped with *telecoils,* typically use ordinary headphones or earbuds. For people with telecoil-equipped hearing aids, *neckloops* or *silhouettes* can be used. Other technologies, such as wireless Bluetooth, are also finding new applications in Assistive Listening.

A **telecoil** (aka t-coil, t-switch) is a tiny coil of wire built into a hearing aid. It picks up the electromagnetic signal created by telephone handsets (hence the name), neckloops, silhouettes and large area induction loop systems. The telecoil changes the signal into a tiny electrical current. The hearing aid converts the electrical current into sound. Telecoils are often sensitive to electromagnetic interference generated by fluorescent lighting, transformers, televisions or other electronic devices.

A **neckloop** is a loop of wire worn like a necklace by a person with a telecoil-equipped hearing aid. When plugged into the speaker or headphone output of an audio device, it converts the audio signal into an electromagnetic signal that can be picked up by a telecoil. The neckloop is the personal version of a large area loop induction system.

Silhouettes work in the same manner as neckloops, using electromagnetic induction. They are typically flat, crescent-shaped discs that fit between a user's BTE (behind the ear) hearing aid and the head, and attach to the headphone output of an ALD. Other similar devices may attach to or surround a hearing aid, providing the necessary electromagnetic coupling to a t-coil.

There are many ways to alert people who are deaf or hard of hearing to an event or situation. All that is needed is a way to get their attention to let them know something is happening. Coupling for alerting systems can be customized to the needs and environment of the users. Multi-sensory alerting systems combine sound, light, and/or vibration to get a person's attention. Such approaches are becoming mainstream practices. In most public buildings today, bright flashing strobe lights accompany loud audible fire alarms. Flashing household lamps or strobes, vibrating bed shakers, and extra loud alarms can alert the deaf or hard of hearing individual to any of a number of routine household happenings; a visitor at the door, incoming phone calls, or the completion of a laundry cycle. Different patterns of flashing or vibrating can help distinguish what sort of event is occurring.